State of Agriculture in India

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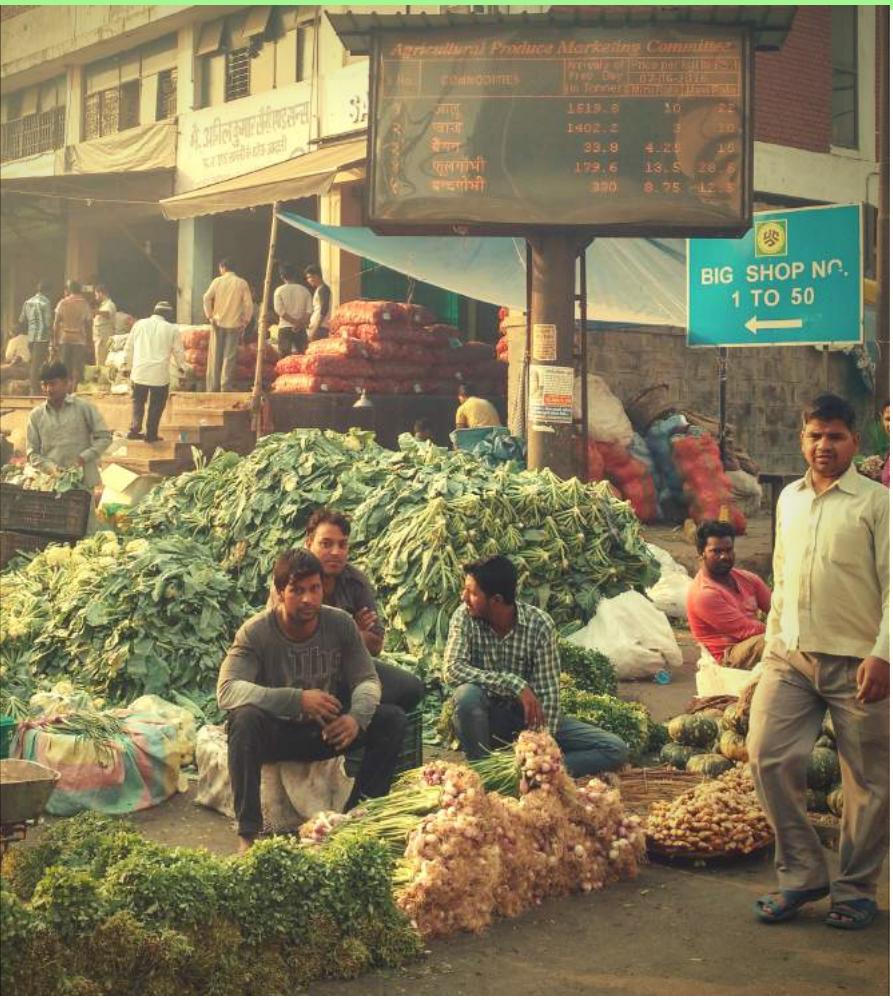


Agriculture output has been volatile

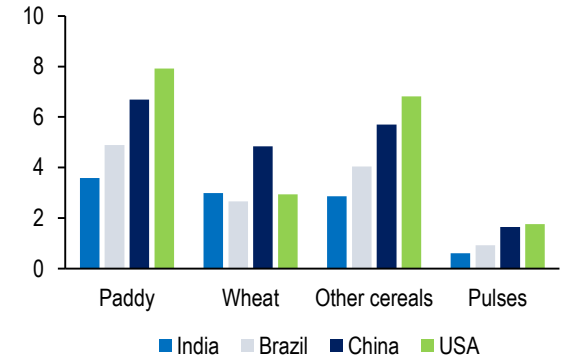
86% of land holdings are less than 2 hectares

Informal sources of credit constitute 40% of loans

INSIGHTS

- The agriculture sector employs nearly half of the workforce in the country. However, it contributes to 17.5% of the GDP (at current prices in 2015-16).
- Over the past few decades, the manufacturing and services sectors have increasingly contributed to the growth of the economy, while the agriculture sector's contribution has decreased from more than 50% of GDP in the 1950s to 15.4% in 2015-16 (at constant prices).
- India's production of food grains has been increasing every year, and India is among the top producers of several crops such as wheat, rice, pulses, sugarcane and cotton. It is the highest producer of milk and second highest producer of fruits and vegetables. In 2013, India contributed 25% to the world's pulses production, the highest for any one country, 22% to the rice production and 13% to the wheat production. It also accounted for about 25% of the total quantity of cotton produced, besides being the second highest exporter of cotton for the past several years.

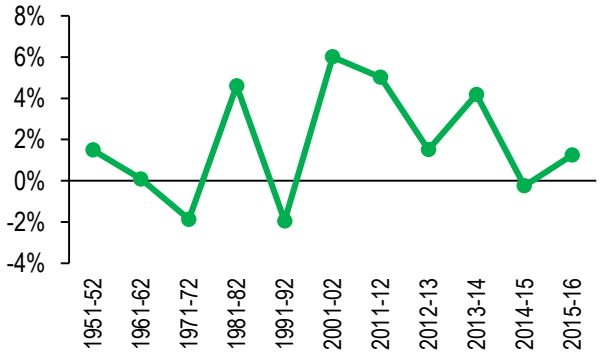
Figure 1: Yield in different countries (tonne/ha)



Sources: Food and Agriculture Organization of the United Nations; PRS.

- However, the agricultural yield (quantity of a crop produced per unit of land) is found to be lower in the case of most crops, as compared to other top producing countries such as China, Brazil and the United States.
- Although India ranks third in the production of rice, its yield is lower than Brazil, China and the United States. The same trend is observed for pulses, where it is the second highest producer.

Figure 2: Agricultural growth (in %)



Sources: Agricultural Statistics at a Glance, 2015; PRS.

- Agricultural growth has been fairly volatile over the past decade, ranging from 5.8% in 2005-06 to 0.4% in 2009-10 and -0.2% in 2014-15.
- Such a variance in agricultural growth has an impact on farm incomes as well as farmers' ability to take credit for investing in their land holdings.

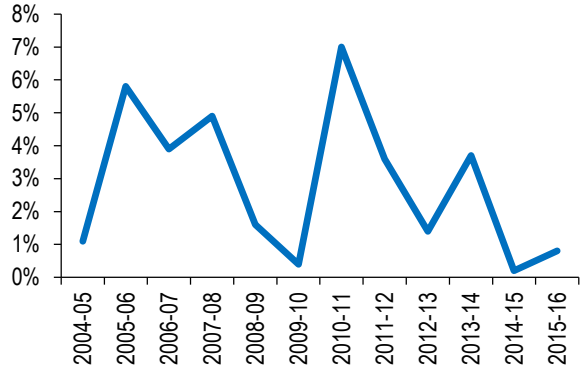
- Key issues affecting agricultural productivity include the decreasing sizes of agricultural land holdings, continued dependence on the monsoon, inadequate access to irrigation, imbalanced use of soil nutrients resulting in loss of fertility of soil, uneven access to modern technology in different parts of the country, lack of access to formal agricultural credit, limited procurement of food grains by government agencies, and failure to provide remunerative prices to farmers.
- Some of the recommendations made by committees and expert bodies over the years include bringing in agricultural land leasing laws, shifting to micro-irrigation techniques to improve efficiency of water use, improving access to quality seeds by engaging with the private sector, and introducing a national agricultural market to allow the trading of agricultural produce online.

State of Agriculture of India

Agricultural productivity depends on several factors. These include the availability and quality of agricultural inputs such as land, water, seeds and fertilizers, access to agricultural credit and crop insurance, assurance of remunerative prices for agricultural produce, and storage and marketing infrastructure, among others. This report provides an overview of the state of agriculture in India. It discusses factors related to the production and post-harvest activities in agriculture.

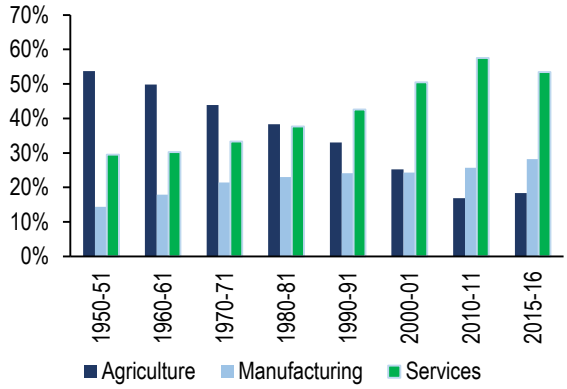
As of 2009-10, more than half of the total workforce (53%) of the country, i.e. 243 million persons were employed in agriculture.[1] The share of population depending on agriculture for its livelihood consists of landowners, tenant farmers who cultivate a piece of land, and agricultural labourers who are employed on these farms. Agricultural output has been volatile over the past 10 years, with annual growth ranging from 8.6% in 2010-11, to -0.2% in 2014-15 and 0.8% in 2015-16.[2] Figure 3 shows the trend in the growth of agricultural sector over the past 10 years.

Figure 3: Growth in agriculture sector (%)



Sources: Agricultural Statistics at a Glance 2015, Ministry of Agriculture; PRS.

Figure 4: Contribution to GDP of sectors (%)



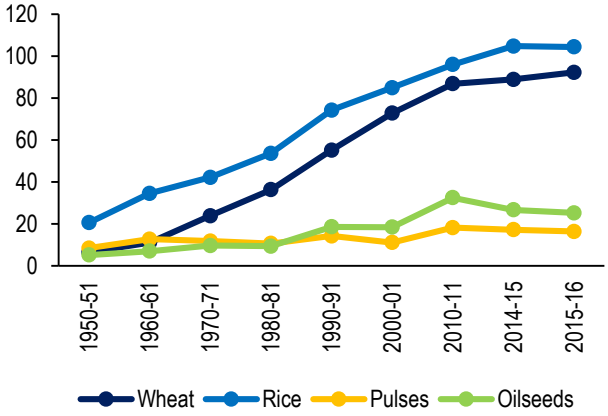
Sources: Ministry of Statistics and Programme Implementation; PRS.

As seen in Figure 4, the agriculture sector's contribution to the Gross Domestic Product (GDP) decreased from 54% in 1950-51 to 15.4% in 2015-16, while that of the services sector increased from 30% to 53%.[3,2] While the agriculture sector's contribution to GDP has decreased over the past few decades, the contribution of sectors such as manufacturing (employing 10.5% of the population) and services (employing 24.4% of the population) has increased.[1]

Agricultural production and yield

Figure 5 shows the production of crops over the past few decades. The production of major crops over the past few decades is shown in Table 7 in the Annexure.

Figure 5: Agricultural production (million tonnes)



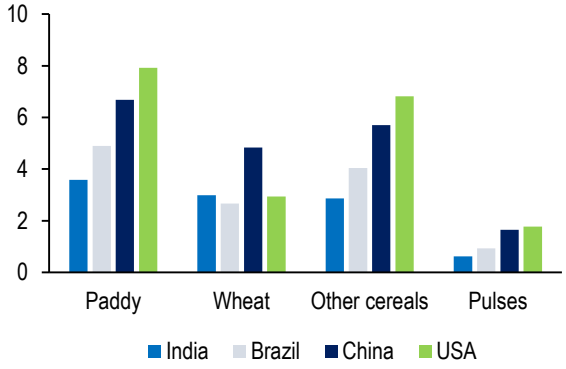
Sources: Ministry of Agriculture; PRS.

- Total production of food grains increased from 51 million tonnes in 1950-51 to 252 million tonnes in 2015-16.[4] According to the second advance estimate by the Ministry of Agriculture, food grains production is estimated to be 272 million tonnes in 2016-17.[5]
- The production of wheat and rice took off after the green revolution in the 1960s, and as of 2015-16, wheat and rice accounted for 78% of the food grains production in the country.

The country's requirement for food grains in order to provide for its population is projected to be 300 million tonnes by 2025.[6] The estimate of food grains production in 2015-16 is 252 million. This implies that the crop output needs to grow at an annual average of 2%, which is close to the current growth trend.

Despite high levels of production, agricultural yield in India is lower than other large producing countries. Agricultural yield is the quantity of a crop produced on one unit of land. Agricultural yield of food grains has increased by more than four times since 1950-51, and was 2,070 kg/hectare in 2014-15.[7] However, as seen in Figure 6, India's yield is low when compared to countries such as China, Brazil and the USA.

Figure 6: Yield in different countries in 2014-15 (in tonne/ha)



Sources: Food and Agriculture Organization of the United Nations; PRS.

- Although India is the second highest producer of paddy (rice) in the world (as of 2013), its yield is lower than China, Brazil and the USA. It is also the leading producer of pulses, but its yield is the lowest.[8,9]
- India's productivity has also grown at a slower rate as compared to others. For instance, while Brazil's yield for rice increased from 1.3 tonne/ha in 1981 to 4.9 tonne/ha in 2011, India's increased from 2.0 to 3.6. China's productivity in rice also grew from 4.3 to 6.7 in this period.

Food security and nutrition

Besides providing for the livelihood of farmers and labourers, the agricultural sector also addresses food security for the nation. The Food and Agricultural Organisation (FAO) of the United Nations defines food security as a situation where all people have, at all times, physical and economic access to sufficient, safe and nutritious food that meets the dietary needs and food preferences for a healthy and active life.[10] Despite high levels of production in the country, 15% of the population continues to be under-nourished, as per 2014 estimates.[11,12]

India enacted the National Food Security Act in 2013. The 2013 Act aims to provide food and nutritional security to people by ensuring access to adequate amount of quality food at affordable prices.[13] Under the 2013 Act, persons belonging to certain categories are provided with food grains (wheat, rice and coarse cereals) at subsidised prices. As of 2015, 68% of the population, i.e. 81 crore persons (of which 77% are in rural areas and 23% in urban areas) are covered under the Act.[14]

Over the past few decades, with increasing per capita income and access to a variety of food groups, the consumption pattern of food in the country has been changing. Dependence on cereals for nutrition has decreased and the consumption of protein has increased.[15] Sources of protein include pulses, meat, seafood, and eggs, among others. According to a Finance Ministry report on incentivising the production of pulses in the country, poor levels of nutrition suggest that increasing the consumption of proteins should be the policy priority for the government.[16] The report estimates that the cost of pulses as a source of protein is lower than other sources. Under the current domestic scenario, India is facing a shortage of pulses which is being plugged by imports.

Agricultural trade

Major commodities imported to India are pulses, edible oils, fresh fruits and cashew nuts. Major commodities exported by India are rice, spices, cotton, meat and its preparations, sugar, etc. Over the past few decades, the share of agricultural imports in total imports has increased from 2.8% in 1990-91 to 4.2% in 2014-15, whereas the share of agricultural exports has reduced from 18.5% to 12.7%.[17] Tables 1 and 2 show the major agricultural exports and imports over the past three years.

Table 1: Agricultural exports (in $ billion)

Commodity	2013-14	2014-15	2015-16
Rice	6.2	7.8	7.9
Meat and meat preparations	3.3	4.5	4.9
Processed foods	2.8	2.7	2.7
Spices	2.8	2.5	2.4
Oil meals	3.0	2.8	1.3
Sugar	1.6	1.2	0.9
Wheat	1.9	1.6	0.8
Pulses	0.2	0.3	0.2
Agriculture exports	**32.0**	**33.0**	**30.1**

Sources: Annual Reports, Department of Commerce; PRS.

Table 2: Agricultural imports (in $ billion)

Commodity	2013-14	2014-15	2015-16
Pulses	2.4	1.8	2.8
Cashew	1.0	0.8	1.1
Vegetable oils	9.9	7.2	10.6
Fresh fruits	1.1	1.3	1.6
Spices	0.5	0.6	0.7
Sugar	0.6	0.4	0.6
Cocoa products	0.2	0.2	0.3
Natural Rubber	0.8	0.9	0.8
Agriculture Imports	**16.8**	**14.9**	**15.9**

Sources: Annual Reports, Department of Commerce; PRS.

India's trade policy is affected by factors such as domestic availability of commodities, cost of production as well as global price levels.[18] However, frequent changes in trade policy, such as reducing the import duty on a commodity in response to a shortage in supply, or decreasing minimum export price of a commodity to facilitate its exports, may have an adverse effect on the development of the agro-processing sector.[18]

Factors affecting agricultural productivity

Increase in small land holdings

140 million hectare of land is used as agricultural area, as of 2012-13.[19] Over the years, this area has been fragmented into smaller pieces of land. As seen in Table 3, the number of marginal land holdings (less than one hectare) increased from 36 million in 1971 to 93 million in 2011.[20] Marginal and small land holdings face a number of issues, such as problems with using mechanisation and irrigation techniques.

Table 3: Agricultural holdings (millions)

Holding	1970-71	1980-81	1990-91	2000-01	2010-11
Marginal	36	50	63	75	93
Small	13	16	20	23	25
Medium	19	21	22	21	20
Large	3	2	2	1	1
All sizes	**71**	**89**	**107**	**120**	**138**

Note: Marginal: up to 1 hectare, Small: 1-2 hectares, Medium: 2-10 hectares, Large: over 10 hectares.
Sources: Agriculture Census 2011; PRS.

Since smaller land holdings are either fragments of larger holdings which have been passed on within the family or have been informally leased by a large holder, farmers who cultivate these holdings often do not have a formal lease agreement. The absence of such land records does not allow these farmers to access formal credit or be eligible for government benefits such input subsidies or crop insurance schemes.

Land records and informal leasing

Of the total agricultural area under operation, 10% of land has been given out on agricultural leases, with the percentage of leased out land varying across states.[21] 34% of the land in Andhra Pradesh, 25% in Punjab, 21% in Bihar and 18% in Sikkim has been leased out. In the past, states such as

Karnataka and West Bengal have attempted to provide legal rights to tenant farmers by forming electronic records of land holdings and giving tenant farmers the right to their produce.[22,23]

E-Bhoomi project in Karnataka

The E-Bhoomi project was started by the Government of Karnataka in the early 2000s. The project aims to computerize existing land records and create a transparent system for changing land records and dividing or merging plots of land. Under the system, farmers can collect land record information for their plot at the Tehsil level, called *Pahani*. These records would contain information such as the survey number of the land, land owner's details, the classification of the soil, and details regarding irrigation and crops grown, among others. The *Pahani* would enable the farmer to (i) know whether the plot he wants to purchase is genuine, (ii) raise farm credit from banks, (iii) use the land records for official or legal purposes. E-Bhoomi also allows farmers to approach the government to address grievances.

Currently, laws of tenancy of agricultural land vary across different states.[21] States such as Kerala, Jammu and Kashmir and Manipur completely prohibit the leasing of agricultural land. Others such as Bihar, Karnataka, Uttar Pradesh, Telangana and Odisha allow land leasing only by certain categories of land owners. On the other hand, states such as Gujarat, Maharashtra, and Assam do not explicitly prohibit leasing, and allow the tenant to purchase the land from the owner after a specified period of tenancy. In Andhra Pradesh, Tamil Nadu and West Bengal, there is no legal ban on leasing land. Different states also have different ceilings on the area of land which may be leased.[21]

The NITI Aayog has proposed a Model Land Leasing Law to provide for the legalisation of land leasing.[21] This would ensure that land owners have the security of ownership rights, and land tenants are secure in their tenancy. Legalisation of land tenancy would also ensure that farmers get access to formal credit, insurance, and inputs such as fertilizers. Table 16 in the Annexure provides details regarding land leasing restriction and the extent to which the Model land leasing law has been adopted in states.[24] Only Madhya Pradesh has adopted the Model land leasing law so far.

***Bargadar* system in West Bengal**

The West Bengal Land Reforms Act, 1955 provides certain rights to *Bargadars* or land tenants. *Bargadars* are persons lawfully cultivating any land belonging to another person (who is not a family member). Under the Act, produce from the farm is divided between the tenant and owner in a 50:50 proportion if the cattle, manure and seeds are provided by the landowner, and 75:25 in all other cases. Illegal eviction of tenants is a cognizable offence punishable with imprisonment or fine, under the Act. However, it does not provide any ownership rights to the tenant.

Access to agricultural credit and insurance

Access to agricultural credit is linked to the holding of land titles. As a result, small and marginal farmers, who account for more than half of the total land holdings, and may not hold formal land titles, are unable to access institutionalized credit.[25] Farmers may require credit for short term uses such as purchasing inputs, weeding, harvesting, sorting and transporting, or long term uses such as investing in agricultural machinery and equipment, or irrigation. Table 4 shows the distribution of agricultural loans according to sources, as of 2013.

Table 4: Land holdings and sources of agricultural credit (as of 2013)

Size of land (hectare)	Co-operative society	Bank	Money lender	Shopkeeper/ trader	Relatives/ friends	Others
0-1	10%	27%	41%	4%	14%	4%
1-2	15%	48%	23%	2%	8%	6%
2-4	16%	50%	24%	1%	6%	4%
4-10	18%	50%	19%	1%	7%	6%
10+	14%	64%	16%	1%	4%	2%

Sources: Table 3.2, Report of the Committee on Medium-term Path on Financial Inclusion, Reserve Bank of India; PRS.

Farmers with land holdings of less than a hectare primarily borrow from informal sources of credit such as moneylenders (41%), whereas those with land holdings of two or more hectares primarily borrow from banks (50% or more). Other major sources of agricultural credit include shopkeepers, relatives or friends, and co-operative societies. Key issues relating to agricultural credit are lack of access to formal credit owing to unclear land records, skewed ratio between short term and long term agricultural credit, and inadequate access to crop insurance. These are summarized below.[25]

Short term and long term credit

Short term credit is generally taken for pre-harvest and post-harvest activities such as weeding, harvesting, sorting and transporting. Long term credit is generally taken in order to invest in agricultural machinery and equipment, irrigation and other developmental activities, etc. Over the past few decades, the trend of short term and long term agricultural credit in the country has reversed. In 1990-91, a majority of crop loans taken was long term credit, whereas short term credit accounted for only about a quarter of all agricultural loans.[26] As of 2011-12, 61% of crop credit was short term, whereas long term credit had a share of 39%.[27]

In addition, small and marginal farmers, who account for about 86% of total land holdings, take more short term loans than farmers with medium or large land holdings. This group of farmers also has the highest share of borrowings from informal sources of credit such as moneylenders, family and friends.

Inadequate access to crop insurance

As of 2011, about 10% of Indian farmers were covered under a crop insurance scheme.[28] Some persistent issues with the crop insurance system include (i) unawareness about insurance schemes, (ii) inadequate coverage of insurance schemes, (iii) assessment of the extent of damages in case of crop losses, and (iv) timely settlement of claims.[29]

The Standing Committee on Finance has recommended that assessment of crop damage should be completed and compensation should be deposited directly into farmers' accounts in a timely manner.[29] In addition, to reduce the seeking of unproductive credit, the government should create awareness about what crops should be grown based on the quality of soil and incidence of rainfall, etc. in different regions.[29]

Pradhan Mantri Fasal Bima Yojana

The Pradhan Mantri Fasal Bima Yojana was launched by the central government in January 2016.[30] The scheme aims to provide insurance coverage to farmers for crop failure, stabilise farmers' income, and encourage farmers to adopt modern agricultural practices, among others. The scheme has been allocated Rs 9,000 crore in the Union Budget 2017-18, compared to Rs 5,501 crore in 2016-17.[31,32] The scheme covers all farmers, including tenant farmers and sharecroppers, who are growing notified crops in notified areas. It covers crops such as cereals, pulses, oilseeds, vegetables, and spices. As of December 2016, the scheme has covered 367 lakh farmers for a sum of Rs 1,41,625 crore in the Kharif season of 2016, as compared to 309 lakh farmers and a sum of Rs 69,307 crore in the Kharif season of 2015.[33,34,35]

A Committee on Financial Inclusion under the Reserve Bank of India had recommended that credit eligibility certificates, which would act as tenancy/lease certificates should be issued to tenant farmers.[25] These certificates would enable also landless cultivators to obtain agricultural credit. It recommended that the Reserve Bank of India should issue guidelines to banks, to give loans to farmers against these certificates.

Availability of water

Currently, about 51% of the agricultural area cultivating food grains is covered by irrigation.[36] The rest of the area is dependent on rainfall (rain-fed agriculture). Sources of irrigation include ground water (wells, tube-wells) and surface water (canals, tanks). Table 5 shows the various sources of irrigation used in agriculture.

Table 5: Sources of irrigation (as of 2010-11)

Source of Irrigation	% share of holdings	Number of holdings
Tube wells	44.2%	31,722
Canals	25.7%	18,414
Wells	19.7%	14,101
Other sources	8.4%	6,046
Tanks	5.8%	4,180

Sources: Agriculture Census 2011; PRS.

- There is a need to improve the efficiency of water use, especially in agriculture. Irrigation currently consumes about 84% of the total available water in the country.[37]
- Nearly 65% of the irrigated land holdings use ground water sources such as tube wells and wells for irrigation.

The past few decades has led to an overuse of ground water sources in states, especially those growing water intensive crops such as rice. For instance, in Haryana and Rajasthan, 40%-75% of the ground water units are over-exploited, and the situation is worse in Punjab, where 75%-90% of ground water units have been over-exploited.[38] Details of ground water development across states may be found in Table 15 in the Annexure.

The Commission for Agricultural Costs and Prices has recommended that quantitative ceilings should be fixed on the per hectare use of water.[39] In addition, farmers using lesser water than the ceiling fixed should receive money equivalent to remaining units of water at the current domestic costs. This would incentivize them to ration their use of water.

In 2011 and 2013, the government released Model Bills for Ground Water Management, based on which states could formulate their own laws.[40] It also launched a Policy in 2012 relating to water demand management, efficiency of water usage, and pricing.[41] The Model Bills were based on the doctrine of public trust, under which resources meant for public use cannot be converted into private ownership. More recently, the Ministry of Water Resources circulated a Model Bill for Groundwater, 2016, which may be adopted by states.[42] The Bill provides an institutional framework for the protection and management of groundwater. It states that groundwater is a common resource of all persons, and ownership of the land over a groundwater resource should not deprive others from accessing it. It also states that industrial or bulk usage of groundwater will be priced.

Micro-irrigation techniques

The Economic Survey 2015-16 observed that India largely uses the technique of flood irrigation, where water is allowed flow in the field and seep into the soil.[43] This results in the wastage of water since excess water seeps into the soil or flows off the surface without being utilised. It has been recommended that farmers should move from flood irrigation to the drip or sprinkler irrigation systems (micro irrigation).[44] This would help in conserving water as well as save on the cost of irrigation. Using micro-irrigation systems (such as drip or sprinkler irrigation) has also been linked to an increase in the yield of crops.

Note that India uses 2-3 times as much water to produce one tonne of grain as countries such as China, Brazil and the United States.[43] If India also increases its efficiency of water use, it will be able to cover a wider area for irrigation. Table 14 in the Annexure provides a state-wise coverage of micro-irrigation in the country.

Soil and fertilizers

Quality of soil

Soil is one of the most important factors in the productivity of agriculture. Indian soil consists of primary nutrients such as nitrogen, phosphorous and potassium, secondary nutrients such as sulphur,

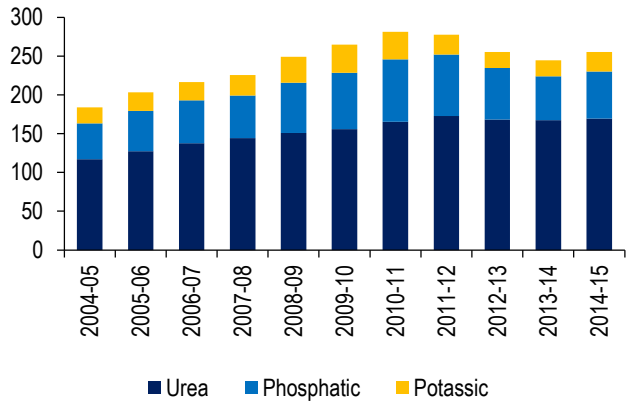
calcium and magnesium, and micro-nutrients such as zinc, iron, and manganese.[45] While the levels of food production have increased over the past few decades, it has also led to issues such as an imbalance of nutrients in the soil, decline in the water table as well as the quality of water, and overall depletion of soil health. The Ministry of Agriculture has noted that the quality of Indian soil is deteriorating.[46] About 5.3 billion tonnes of soil gets eroded annually, at a rate of about 16.4 tonne/hectare.

Imbalance in the use of fertilizers in soil may also result in a loss of fertility. If farmers are unaware about the kind of fertilizer which is required for the soil in which they sow their crops, the productivity of the soil will be subsequently affected. The Soil Health Card scheme was launched by the central government in 2015. Under the scheme, all farmers are issued soil health cards, once every three years. The soil health cards contain information such as the nutrient status of the soil, and the recommended dose of nutrients to be provided to the soil to improve its fertility. As of February 2017, 2.9 crore farmers have been covered under this scheme.[47] 2.5 crore soil samples have been collected, and 1.8 crore samples have been tested.[48] The Ministry had set a target of 2.53 crore samples to be collected by March 2017.

Imbalance in use of fertilizers

The manufacture, sale, and distribution of fertilizers in the country is regulated by the Ministry of Chemicals and Fertilizers, under the Essential Commodities Act, 1955. There are three major types of nutrients used as fertilizers: Nitrogen (N), Phosphatic (P), and Potassic (K). Of these, the pricing of urea (containing N fertilizer) is controlled by the government, while P and K fertilizers were decontrolled in 1992, on the recommendation of a Joint Parliamentary Committee. It has been observed that urea is used more than other fertilizers. While the recommended ratio of use of the NPK fertilizers is 4:2:1, this ratio in India is currently at 6.7:2.4:1.[6] Overuse of urea is especially observed in the states of Punjab, Haryana and Uttar Pradesh.[6] Figure 7 shows the trend in the consumption of fertilizers over the past decade.

Figure 7: Consumption of fertilizers (lakh tonnes)



Sources: Agricultural Statistics at a Glance 2015; PRS.

An imbalanced use of urea may lead to a loss of fertility in the soil over a period of time, affecting productivity. Urea (N) is the most produced (86%), consumed (74%) and imported (52%) fertilizer in the country.[49] The government determines the quantity of fertilizers to be imported based on their domestic availability.

However, the process of fixing the quantity to be imported and actually receiving the imports takes about 60-70 days, since only three companies are allowed to import urea into the country. Thus shortages are often caused in the urea market. Since farmers have to ensure that urea is applied to their crops on time, it leads to the growth of black markets selling urea, often at prices above the maximum retail prices.[49]

The level of fertilizer required for a crop depends upon the soil type, level of yield, and water availability, in addition to the type of crop.[6] Certain crops such as rice, wheat, maize, cotton and sugarcane require larger quantities of nitrogen as compared to pulses, fruits and vegetables. Although the ratio of N, P, and K fertilizer usage across crops has increased, the quantity of fertilizers used by India is still lower as compared to other countries. The average consumption of fertilizers increased from 106 kg per ha in 2005-06 to 128 kg per ha in 2012-13. In comparison, Pakistan consumes 205 kg per ha and China consumes 396 kg per ha.

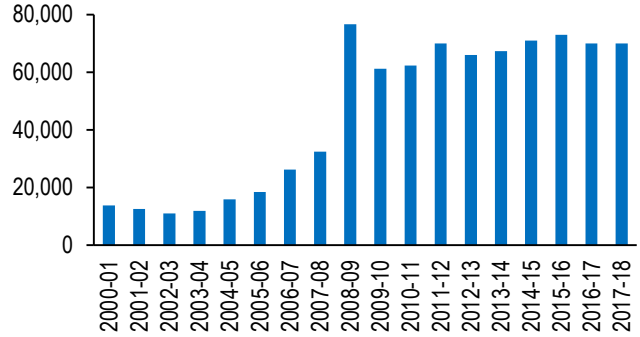
Nutrient based subsidy policy

The central government launched the nutrient based subsidy policy (NBS) in 2010 for P and K fertilizers. The policy was formulated with the objective of promoting a balanced use of N, P and K fertilizers. The policy allowed the manufacturers of P and K fertilizers to fix their maximum retail prices (MRPs) at reasonable levels. The subsidy provided would be based on per kilogram of the nutrient. The policy also provided for an additional subsidy to be paid to indigenous manufacturers of fertilizers. The Comptroller and Auditor General of India, in its report on the performance of the NBS policy stated that in the five years since its implementation, the policy had not succeeded in bringing about a balanced use of fertilizers.[50] The fertilizer usage ratio of urea increased from 4.3 in 2009-10 to 8.2 in 2012-13.

To meet the production target of 300 million tonnes of food grains by 2025 which was mentioned earlier, 45 million tonne of fertilizers would be required. Of this, 6-7 million tonnes may be met from organic fertilizers, but the rest would be met by chemical fertilizers (containing N, P and K). The domestic production of fertilizers would have to be increased to meet this demand.[6]

Fertilizer Subsidy

Figure 8: Fertilizer subsidy (in Rs crore)



Note: Subsidy figure for 2016-17 is a revised estimate, and for 2017-18 is a budgeted estimate.
Sources: Expenditure Budget, Union Budgets 2000-01 to 2017-18; PRS.

To promote the use of fertilizers by farmers, the central government provides a fertilizer subsidy to the producers of fertilizers. In 2017-18, Rs 70,000 crore has been allocated for fertilizer subsidy, which is the second biggest expenditure on subsidy after food subsidy.[32]

Allocations for fertilizer subsidy have been increasing at an annual rate of 11.4% between 2000 and 2016. Of the subsidy allocated for 2017-18, Rs 49,768 crore has been allocated for subsidy on urea. Figure 8 shows the trend in the fertilizer subsidy 2000-01 onwards.

Currently the amount of subsidy to be given is determined based on the cost of production of the fertilizer company.[49] Companies with a higher cost of production receive greater subsidies. This reduces the companies' incentive to reduce their cost of production. Although the consumption of urea has been increasing over the past decade, no new domestic production capacity has been added in the past 15 years.[49]

A Committee that examined the role of Food Corporation of India recommended that cash transfers should be made to farmers to replace the current fertilizer subsidy regime.[51] This would allow farmers to choose fertilizers in the combination best suited to their needs, and help them to fix the fertilizer imbalance in soil. In the Union Budget 2016-17, it was announced that a direct benefit transfer program for fertilizers would be launched on a pilot basis in a few districts across the country.[52] In July 2016, the government announced that it would be conducting pilot studies of direct benefit transfers in 16 districts in 2016-17.[53]

Use of pesticides

The consumption of chemical pesticides in the country has increased over the past few years, from 55,540 tonne in 2010-11 to 57,353 tonne in 2014-15.[54] Over this time period, the imports of pesticides also increased from 53,996 tonne to 77,376 tonne. Issues with regard to the use of pesticides include use of low-quality pesticides, and a lack of awareness about pesticide use. The Economic Survey 2015-16 noted that the use of pesticides without proper guidelines has led to an increase in pesticide residue being found in food products in India.[18]

While the production of pesticides is monitored by the Ministry of Chemicals and Fertilizers, their usage is administered by the Ministry of Agriculture. There is a need to review the Insecticide Act, 1968, to provide for a regulatory framework for the pesticides sector.[6] The Standing Committee on Agriculture has also recommended that a Pesticides Development and Regulation Authority be created to regulate the manufacturing, import and sale of pesticides in the country.[6] Other recommendations include developing an integrated pest-management system, which includes a mix of the mechanical and biological methods of pest control, and encourages the use of bio-pesticides.[18]

Access to quality seeds

Quality seeds is another input necessary for agricultural productivity, and good quality seeds account for 20%-25% of increased crop productivity.[55] Seeds are regulated by the Seeds Act, 1966. The Act regulates the quality, production, and sale of seeds. The Seeds Control Order, 1983 regulates the licenses to sell, export and import seeds. Three varieties of seeds commonly used are (i) farm-saved seeds, which account for 65%-70% of the total seeds consumption, (ii) commercially produced seeds of the breeder, foundation and certified varieties, and (iii) genetically modified and hybrid seeds.

Agricultural seeds are produced by various agencies such as Indian Council of Agricultural Research and its research institutions, state agricultural universities, and national and state seeds corporations. The private sector has also started playing a role in supplying some seeds such as hybrid maize, bajra, cotton and sunflower. Some of the challenges identified in the development and distribution of quality seeds are (i) access to quality seeds, and (ii) inadequate research support.[56]

About 30%-35% of the total seeds available are produced by private and public sector companies, and farm bred seeds account for the remaining seeds.[18] While farmers can develop certain varieties of seeds from the crops harvested on their land, high-yielding varieties of seeds have to be purchased from the market. The cost of these varieties is too high for marginal and small farmers to afford, thus disincentivising them from purchasing these varieties.[43] The Economic Survey 2015-16 has recommended bringing in more players into the production of seeds, to improve their availability in the market and also reduce their prices.

Genetically modified seed varieties

Genetically modified (GM) seeds are those where certain genes are modified to develop traits such as a resistance to pests and herbicide, and increased productivity. Bt cotton is currently the only approved GM technology seed in India. It was adopted in India in 2002 and as of 2014, 92% of the area covered by cotton uses Bt cotton.[57] After releasing Bt cotton in the country, the crop's yield increased from 190 kg/ha in 2000-01 to 461 kg/ha in 2014-15.[58]

Over the years, various GM crops such as Bt brinjal have been developed, but they have not received the regulatory approval to be released in Indian markets. Under the existing regulatory process, the Genetic Engineering Appraisal Committee (GEAC) under the Ministry of Environment, Forest and Climate Change, approves proposals for the commercial use of GM seeds.[59] In September 2016, the GEAC invited public comments on a report authorising the environmental release of GE mustard.[60,61] The Ministry of Environment is yet to provide the final approval for GE mustard to be released commercially.

Agricultural machinery

Mechanization is another aspect with a significant impact on agricultural productivity. The use of agricultural machinery in agriculture enables agricultural labour to be used in other activities. It makes activities such as tilling, spreading of seeds and fertilizers and harvesting more efficient, so that the cost of inputs is offset. It can also make the use of labour in agriculture more cost-effective.

The status of mechanisation in agriculture varies for different activities, although the overall level of mechanisation is still less than 50%, as compared to 90% in developed countries.[62] The highest level of mechanisation (60%-70%) is observed in harvesting and threshing activities and irrigation (37%). The lowest level of mechanisation is found in seeding and planting. To increase productivity, farm

equipment which is durable, light-weight and low cost, and also specific to different crops and regions should be made available for small and marginal farmers.[62]

Some challenges faced by farm mechanisation include different soil and climatic zones which require customised farm machinery, and small land holdings with lack of access to resources. Mechanisation should aim to increase agricultural efficiency by reducing the time and labour requirement, minimising wastage and reducing costs of labour.[63]

Post-harvest activities

Storage facilities

After agricultural produce is harvested, it requires a robust storage infrastructure in order to minimise any losses due to adverse weather conditions or in the process of transportation. The quantity of food which is wasted during the harvest and post-harvest processes in the country has increased over the past five years.[18] The highest losses are observed in the case of fruits and vegetables (4.6%-15.9% of production in 2015), pulses (6.4%-8.4%) and oilseeds (5.3%-9.9%).

Food wastage occurs at all levels of farming- the farmer, transporter, wholesaler and retailer. Some of the reasons for this wastage are crop damage, improper harvesting techniques, poor packaging and transportation, and poor storage. Some of the issues with the state of storage facilities in the country are inadequate capacity and poor conditions of storage.[64] In cases where the storage capacity is found to be sufficient, the conditions of the godown are unfit, either because of the damp condition of the storage or because of its remote location.

Food grains from the central pool are stored in warehouses managed by the Central Warehousing Corporation (CWC), under the Department of Food and Public Distribution. As of December 2016, the CWC was operating 438 warehouses with a total capacity of 9.7 million tonnes. State Warehousing Corporations manage storage facilities at the state level. As of December 2016, 19 such SWCs were operating 1,757 warehouses with a total capacity of 26 million tonnes.[65]

Another system for the storage of agricultural commodities is the negotiable warehousing system, regulated by the Warehousing Regulatory and Development Authority. Under this system, farmers who store their produce are issued a receipt with details of the location of the warehouse, and the quality and quantity of the produce being stored. This receipt acts a collateral in case the farmer wants to access agricultural credit.[66] As of 2015, a storage capacity of 118 million tonnes was with warehouses registered with the WRDA. Of this, 19 million tonne was with the private sector, 15 million tonne with the co-operative sector, and the remaining with government storage.[67]

Since foodstuffs such as certain fruits and vegetables deteriorate faster and lead to wastage, they are stored at cold temperatures to reduce their perishability.[68] Cold storage facilities in the country were set up by the Cold Storage Order, 1964 under the Essential Commodities Act, 1955. Some challenges identified in the development of cold storage in the country are delays in the process of changing land use from agriculture to industrial use, lack of tax exemptions accrued to cold storage for agricultural commodities, availability of power, and accessibility to farmers.[69]

Mega Food Parks

The Mega Food Parks scheme was launched by the Ministry of Food Processing Industries in 2008.[70] The scheme aims to create a mechanism of linking agricultural production to the markets, by involving farmers, processors and retailers together in a cluster-based approach. Expected outcomes of the scheme would be a higher price for farmers from their produce, creation of high quality food processing infrastructure, reduction in food wastage, and creation of an efficient food supply chain, among others. The scheme is being implemented through a Special Purpose Vehicle set up under the Companies Act, 2013. As of July 2016, 42 mega food parks were sanctioned by the Ministry, of which 38 have been approved for implementation and 8 are operational.[71]

Agricultural Pricing

Procurement of agricultural commodities is the purchase of food grains by the central or state governments. The Food Corporation of India is responsible for the purchase, storage, movement, distribution and sale of agricultural produce.[72] Minimum Support Prices are the prices at which the government purchases food grains from farmers.

The largest procurement at MSPs is for rice and wheat. About a third of the wheat and rice produced in the country is procured by the central government. In 2015-16, 33% of the wheat and 30% of the rice produced in the country was procured by the central government. Note that India is a big exporter of wheat; in 2014-15, of the 90.8 million tonnes of wheat produced in the country, 28 million tonnes was procured for the central pool, and 29 million tonnes was exported.

Minimum Support Prices (MSPs)

MSPs are the prices at which the central government purchases food grains from farmers. MSPs are fixed by the central government in order to ensure remunerative prices to farmers. Factors taken into consideration in determining MSPs include costs of cultivation and production, productivity of crops, and market prices.[73] High MSPs of crops provide incentives to farmers to adopt modern technologies and farming practices, to increase the overall productivity of their crops. The government announces MSPs for 22 crops (and a fair and remunerative price for sugarcane), but the Public Distribution System, for which grains are procured, primarily distributes wheat and rice to its beneficiaries. Since procurement is mainly carried out for wheat and rice, farmers have focused on the cultivation of these crops over other crops such as pulses and oilseeds.[37] Table 17 in the Annexure shows the MSPs for crops from 2005-06 to 2015-16.

Effectiveness of MSPs

Although MSPs are declared for various crops, procurement at these prices mainly happens for wheat, rice, sugarcane and cotton, in a few states.[74] As a result, in procuring states, farmers focus on cultivating these crops over other crops such as pulses, oilseeds, and coarse grains. MSPs are declared prior to each sowing season (in June and October) so that farmers are aware of the minimum price the government will offer for their produce. This is meant to encourage them to increase their investment in the production of crops.[74] In a report to measure the efficacy of MSPs, the NITI Aayog found that a low proportion of farmers (10%) was aware of MSPs before the sowing season. 62% of the farmers were informed of MSPs after sowing their crops. The pricing policy of MSPs would be effective only if farmers are aware of it at the time of deciding what crops to grow. The NITI Aayog recommended that the awareness level of farmers regarding MSPs must be increased and the mediums of dissemination of this information must be strengthened.[74]

Other issues with the implementation of the MSP regime include long distances to the procurement centres, increasing cost of transportation for farmers, irregular hours of the procurement centres, lack of coverage storage godowns and inadequate storage capacity, and delays in the payment of MSPs to farmers.[74] The NITI Aayog notes that the agricultural pricing policy needs to be reviewed to ensure that farmers are receiving remunerative prices for their produce. One of the measures it recommends is a price deficiency system. Under such a system, farmers would be compensated for certain commodities if their prices fall under a specified threshold. This would reduce stock-holding by farmers who store commodities until prices increase, and also incentivise farmers to produce different crops. Farmers would be paid by using the direct benefit transfer system, through bank accounts linked to the their Aadhaar numbers.

Agricultural markets

The production, supply and distribution of certain commodities comes under the purview of the Essential Commodities Act, 1955.[75] These commodities include food grains, oilseeds, cotton and woollen textiles, jute, and coal, among others. Under the Act, the central government may control the price at which any essential commodity is traded. It may also regulate licenses for its storage, transport, distribution, disposal or consumption.

Agricultural markets in the country are regulated by state Agricultural Produce Marketing Committee (APMC) laws.[76] Under these state Acts, farmers are required to sell their produce at state-owned mandis. Over the years, several issues have been highlighted in this system. For instance, APMC mandis currently levy a market fee on farmers who wish to sell their produce in the mandis. This makes it expensive for farmers to sell at APMC mandis. In addition, farmers have to arrange for their produce to be transported from their farms to the nearest mandi, which brings in costs such as transport and fuel. In transporting the produce from the farm to the store, several intermediaries are involved. These intermediaries are all paid a certain proportion of the price, as commissions. Thus the market price which the farmer receives for his produce is significantly lower than the price at which his produce is sold to the retailer.

The central government had released a Model APMC Act in 2003, to be enacted by states.[77] The Model Act (i) provides for the direct selling of produce through contract farming, (ii) permits private persons, farmers and consumers to establish agricultural markets, (iii) levies a single market fee on the sale of the commodity, and (iv) replaces licences with registration of market agencies so that they can operate in more than one market, among other things. However, only 18 states and union territories have implemented the reforms laid out in the Model Act.[78] Four states are yet to initiate the reforms, and the remaining states are at various stages of implementing them.

The Economic Survey 2014-15 recommended that a National Agricultural Market (NAM) be created to provide for a national electronic platform on which farmers may sell their produce.[79] Such a market would enable farmers to receive a corresponding price for their produce and also allow them to sell their produce anywhere in the country. In April 2016, the central government launched the National Agricultural Market in 8 states districts, and integrated wholesale mandis in these areas to create a common platform.[80] Information regarding states' progress towards APMC reforms may be found in Table 18 of the Annexure.

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Annexure

Table 6: Number of land holdings in states according to size in 2010-11 (in 100 hectares)

State	Marginal (< 1 ha)	Small (1-2 ha)	Semi-medium (2-4 ha)	Medium (4-10 ha)	Large (> 10 ha)	All holdings
Andaman and Nicobar Islands	46	24	31	16	0	118
Andhra Pradesh	84,247	29,184	13,991	3,973	357	1,31,751
Arunachal Pradesh	215	193	340	279	65	1,093
Assam	18,311	4,966	3,035	849	41	27,202
Bihar	1,47,441	9,480	4,147	815	31	1,61,914
Chandigarh	5	1	1	0	0	7
Chhattisgarh	21,828	8,311	5,030	2,018	277	37,465
Dadra and Nagar Haveli	82	39	18	7	1	147
Daman and Diu	77	5	1	0	0	84
Delhi	113	45	30	15	2	205
Goa	599	98	57	20	6	780
Gujarat	18,156	14,290	10,795	5,127	488	48,856
Haryana	7,781	3,148	2,838	1,947	458	16,173
Himachal Pradesh	6,704	1,746	849	276	33	9,608
Jammu and Kashmir	12,066	1,671	637	114	5	14,494
Jharkhand	18,483	4,289	2,828	1,287	202	27,089
Karnataka	38,488	21,382	12,668	5,107	676	78,322
Kerala	65,797	1,802	570	120	19	68,308
Lakshadweep	99	3	1	0	0	103
Madhya Pradesh	38,910	24,487	16,548	7,891	887	88,724
Maharashtra	67,090	40,523	21,591	7,106	679	1,36,990
Manipur	767	222	28	0	1,506	-
Meghalaya	1,027	578	405	83	2	2,096
Mizoram	502	298	99	17	3	919
Nagaland	65	203	485	780	252	1,784
Odisha	33,683	9,186	3,113	637	56	46,675
Puducherry	285	28	14	4	1	332
Punjab	1,644	1,954	3,245	2,985	697	10,526
Rajasthan	25,115	15,111	13,351	11,271	4,036	68,884
Sikkim	405	169	108	59	8	749
Tamil Nadu	62,666	11,813	5,023	1,506	174	81,182
Tripura	4,991	550	215	28	1	5,785
Uttar Pradesh	1,85,323	30,353	13,343	3,983	253	2,33,255
Uttarakhand	6,721	1,573	648	173	11	9,127
West Bengal	58,527	9,798	2,675	227	7	71,233
Total	**9,28,260**	**2,47,792**	**1,38,956**	**58,750**	**9,728**	**13,83,485**

Sources: Table 15.2(a), Agricultural Statistics at a Glance 2015, Ministry of Agriculture; PRS.

Table 7: Production of crops (in million tonnes)

Year	Rice	Wheat	Coarse cereals	Pulses	Total food grains	Oilseeds	Cotton	Sugarcane
1950-51	21	6	15	8	51	5	3	57
1960-61	35	11	24	13	82	7	6	110
1970-71	42	24	31	12	108	10	5	126
1980-81	54	36	29	11	130	9	7	154
1990-91	74	55	33	14	176	19	10	241
2000-01	85	70	31	11	197	18	10	296
2010-11	96	87	43	18	244	32	33	342
2014-15	105	87	43	17	252	28	35	362
2015-16	104	94	38	16	252	25	30	352

Note: Cotton production is in bales of 170 kg each.
Sources: Agricultural Statistics at a Glance 2015, Ministry of Agriculture; PRS.

Table 8: Top producing states for major crops in 2014-15

State	Production (million tonnes)	% of all India	Yield (kg/ha)	Area under irrigation (%)
Rice				
West Bengal	14.7	14.0	2,731	48.2%
Uttar Pradesh	12.2	11.7	2,082	83.1%
Andhra Pradesh	11.6	11.0	3,036	96.8%
India	**104.8**		**2,390**	**58.3%**
Wheat				
Uttar Pradesh	25.2	28.4	2,561	98.4%
Punjab	15.8	17.7	4,491	98.9%
Madhya Pradesh	14.2	16.0	2,551	90.8%
India	**88.9**		**2,872**	**93.4%**
Maize				
Andhra Pradesh	4.2	17.9	4,257	49.5%
Karnataka	3.9	16.5	2,921	36.0%
Maharashtra	2.2	9.3	2,080	12.7%
India	**23.7**		**2,557**	**25.4%**
Coarse cereals				
Rajasthan	7.6	18.1	1,257	7.4%
Karnataka	6.7	16.0	1,992	20.1%
Andhra Pradesh	4.7	11.3	3,596	39.7%
India	**41.8**		**1,729**	**16.5%**
Pulses				
Madhya Pradesh	4.7	27.4	877	38.5%
Rajasthan	2.0	11.3	580	21.1%
Maharashtra	1.7	10.1	553	9.2%
India	**17.2**		**744**	**18.6%**
Oilseeds				
Madhya Pradesh	7.7	29.0	1,090	5.5%
Rajasthan	5.3	20.0	1,192	60.4%
Gujarat	4.0	14.9	1,550	31.3%
India	**26.7**		**1,037**	**28.3%**
Sugarcane				
Uttar Pradesh	138.5	38.5	62,154	95.1%
Maharashtra	81.9	22.8	78,120	100.0%
Karnataka	41.9	11.7	93,100	100.0%
India	**359.3**		**69,860**	**95.0%**
Cotton (in million bales: 1 bale= 170 kg)				
Gujarat	11.1	31.3	626	58.7%
Maharashtra	7.0	19.8	285	2.7%
Andhra Pradesh	6.6	18.7	444	13.9%
India	**35.5**		**461**	**33.8%**

Sources: Agricultural Statistics at a Glance 2015, Ministry of Agriculture; PRS.

Table 9: State-wise yield of food grains (in kg/ha)

State/UT	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15*
Andhra Pradesh	2,138	2,365	2,231	2,613	2,744	2,294	2,530	2,519	2,670	2,661	2,653
Arunachal Pradesh	1,178	1,212	1,216	1,241	1,255	1,555	1,673	1,778	1,786	1,794	#
Assam	1,405	1,416	1,286	1,378	1,551	1,662	1,763	1,704	1,962	1,916	2,012
Bihar	1,192	1,311	1,656	1,546	1,766	1,530	1,479	2,098	2,366	2,018	1,948
Chhattisgarh	979	1,111	1,148	1,238	1,041	1,008	1,424	1,384	1,506	1,524	1,433
Goa	2,456	2,509	2,254	2,091	2,231	1,990	2,264	2,272	2,361	2,659	#
Gujarat	1,412	1,551	1,423	1,831	1,595	1,560	1,843	1,874	1,970	2,097	1,955
Haryana	3,092	3,045	3,393	3,420	3,388	3,383	3,526	3,879	3,689	3,855	3,772
Himachal Pradesh	1,923	1,731	1,714	1,918	1,757	1,297	1,787	1,911	1,850	1,962	2,011
Jammu and Kashmir	1,686	1,680	1,733	1,711	1,851	1,405	1,639	1,690	1,962	1,915	1,379
Jharkhand	1,234	1,073	1,550	1,709	1,720	1,330	1,257	1,798	1,876	1,891	1,855
Karnataka	1,388	1,776	1,289	1,548	1,511	1,377	1,684	1,629	1,488	1,620	1,684
Kerala	2,278	2,219	2,331	2,221	2,440	2,470	2,399	2,695	2,547	2,530	2,805
Madhya Pradesh	1,131	1,130	1,167	1,069	1,168	1,285	1,162	1,510	1,676	1,603	1,719
Maharashtra	836	948	940	1,150	1,001	1,039	1,184	1,155	1,038	1,207	1,043
Manipur	2,390	2,241	2,241	2,297	2,236	1,796	2,244	2,397	1,926	1,745	#
Meghalaya	1,674	1,455	1,800	1,774	1,783	1,809	1,803	1,873	1,997	2,387	#
Mizoram	1,888	1,754	822	285	898	1,047	1,246	1,382	1,756	1,506	#
Nagaland	1,577	1,615	1,482	1,567	1,811	1,256	1,958	1,967	2,027	2,018	#
Odisha	1,300	1,349	1,369	1,484	1,363	1,262	1,432	1,303	1,592	1,625	1,733
Punjab	4,040	3,986	1,359	4,255	4,231	4,144	4,280	4,364	4,347	4,500	4,144
Rajasthan	1,008	919	4,017	1,180	1,263	931	1,249	1,348	1,480	1,334	1,535
Sikkim	1,406	1,354	991	1,378	1,351	1,496	1,448	1,495	1,608	1,577	#
Tamil Nadu	1,874	1,847	1,354	2,125	2,225	2,477	2,393	3,162	2,131	2,554	2,529
Tripura	2,179	2,194	2,610	2,563	2,526	2,544	2,587	2,620	2,711	2,680	#
Uttar Pradesh	1,961	2,057	2,399	2,206	2,365	2,236	2,386	2,498	2,542	2,484	2,117
Uttarakhand	1,697	1,548	2,057	1,785	1,715	1,780	1,841	1,945	1,962	1,995	1,824
West Bengal	2,479	2,423	1,760	2,525	2,493	2,522	2,601	2,645	2,717	2,721	2,691
Others	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2,778
All India	**1,652**	**1,715**	**1,756**	**1,860**	**1,909**	**1,798**	**1,930**	**2,078**	**2,129**	**2,120**	**2,070**

*4th Advance Estimates.

Sources: Agricultural Statistics at a Glance 2015, Ministry of Agriculture; PRS.

Table 10: State wise yield of wheat (in kg/ha)

State/UT	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15
Andhra Pradesh	818	900	889	1,143	1,000	1,300	1,375	1,250	500	1,000
Arunachal Pradesh	1,525	1,575	1,472	1,576	1,505	1,595	1,757	1,498	1,510	*
Assam	1,074	1,117	1,268	1,090	1,087	1,179	1,147	1,304	1,292	1,257
Bihar	1,617	1,908	2,058	2,043	2,084	1,948	2,206	2,427	2,358	1,851
Chhattisgarh	886	1,002	1,059	1,040	1,086	1,144	1,227	1,396	1,304	1,388
Gujarat	2,700	2,498	3,013	2,377	2,679	3,155	3,014	2,875	3,255	2,810
Haryana	3,844	4,232	4,158	4,390	4,213	4,624	5,030	4,452	4,722	4,574
Himachal Pradesh	1,894	1,385	1,376	1,520	928	1,530	1,671	1,671	1,873	1,800
Jammu and Kashmir	1,790	1,893	1,782	1,735	1,003	1,535	1,689	1,595	2,061	1,200
Jharkhand	1,340	1,529	1,621	1,541	1,738	1,642	1,908	1,944	2,123	1,931
Karnataka	858	762	946	918	887	1,094	858	796	1,005	1,091
Madhya Pradesh	1,613	1,835	1,612	1,723	1,967	1,757	2,360	2,478	2,405	2,551
Maharashtra	1,393	1,325	1,659	1,483	1,610	1,761	1,558	1,528	1,460	1,381
Meghalaya	1,714	2,000	1,833	1,750	1,773	1,791	1,564	1,806	1,881	*
Nagaland	1,583	867	1,067	1,500	1,200	1,712	1,711	1,801	1,823	*
Odisha	1,364	1,487	1,554	1,396	1,450	1,458	1,644	1,894	1,574	1,772
Punjab	4,179	4,210	4,507	4,462	4,307	4,693	4,898	4,724	5,017	4,492
Rajasthan	2,762	2,751	2,749	3,175	3,133	2,910	3,175	3,028	3,083	2,974
Sikkim	1,385	1,385	1,000	1,345	1,135	1,023	1,060	1,058	1,083	*
Tripura	2,636	1,800	1,900	2,000	1,984	2,025	2,000	2,000	2,000	*
Uttar Pradesh	2,627	2,721	2,817	3,002	2,846	3,113	3,113	3,113	3,038	2,561
Uttarakhand	1,633	2,049	2,050	2,003	2,139	2,316	2,379	2,396	2,422	1,902
West Bengal	2,109	2,282	2,602	2,490	2,680	2,760	2,765	2,786	2,791	2,836
All India	**2,619**	**2,708**	**2,802**	**2,907**	**2,839**	**2,989**	**3,177**	**3,117**	**3,145**	**2,872**

Note: Figures for 2014-15 are 4th advance estimates. *in 2014-15, yield of Arunachal Pradesh, Meghalaya, Nagaland, Sikkim and Tripura has been consolidated as 3,902 kg/ha.
Sources: Agricultural Statistics at a Glance 2015; PRS.

Table 11: State wise yield of rice (in kg/ha)

State/UT	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15
Andhra Pradesh	2,939	2,984	3,344	3,246	3,062	3,035	3,148	3,173	2,921	3,036
Arunachal Pradesh	1,195	1,195	1,275	1,293	1,777	1,925	2,065	2,086	2,092	*
Assam	1,468	1,332	1,428	1,614	1,737	1,843	1,780	2,061	2,012	2,135
Bihar	1,075	1,486	1,237	1,599	1,120	1,095	2,155	2,282	1,759	1,951
Chhattisgarh	1,337	1,354	1,446	1,176	1,120	1,663	1,597	1,746	1,766	1,581
Goa	2,822	2,458	2,330	2,466	2,136	2,467	2,577	2,679	2,954	*
Gujarat	1,949	1,894	1,942	1,744	1,903	1,852	2,141	2,198	2,076	2,085
Haryana	3,051	3,238	3,361	2,726	3,008	2,789	3,044	3,272	3,256	3,113
Himachal Pradesh	1,412	1,559	1,546	1,523	1,381	1,673	1,705	1,629	1,625	1,751
Jammu and Kashmir	2,150	2,194	2,133	2,186	1,914	1,942	2,078	3,126	2,250	1,710
Jharkhand	1,150	1,828	2,018	2,031	1,546	1,541	2,131	2,238	2,238	2,210
Karnataka	3,868	2,470	2,625	2,511	2,482	2,719	2,793	2,632	2,666	**2,827**
Kerala	2,284	2,390	2,310	2,519	2,557	2,452	2,733	2,577	2,551	2,818
Madhya Pradesh	999	824	938	927	872	1,106	1,340	1,474	1,474	1,684
Maharashtra	1,770	1,669	1,898	1,489	1,474	1,766	1,837	1,965	1,924	1,891
Manipur	2,322	2,322	2,446	2,357	1,889	2,453	2,642	2,546	2,201	*
Meghalaya	1,508	1,916	1,880	1,886	1,910	1,912	1,988	2,125	2,493	*
Mizoram	1,778	559	288	885	939	1,160	1,411	2,088	1,522	*
Nagaland	1,682	1,600	1,685	1,994	1,426	2,102	2,106	2,204	2,260	*
Odisha	1,531	1,534	1,694	1,529	1,585	1,616	1,450	1,814	1,821	1,989
Punjab	3,858	3,868	4,019	4,022	4,010	3,828	3,741	3,998	3,952	3,838
Rajasthan	1,425	1,577	2,031	1,807	1,515	2,025	1,886	1,771	2,147	2,186
Sikkim	1,433	1,433	1,636	1,476	1,869	1,727	1,730	1,790	1,815	*
Tamil Nadu	2,546	3,423	2,817	2,683	3,070	3,040	3,918	2,772	3,100	3,191
Tripura	2,260	2,472	2,633	2,586	2,606	2,655	2,700	2,800	2,800	*
Uttar Pradesh	1,996	1,879	2,063	2,171	2,084	2,120	2,358	2,460	2,447	2,082
Uttarakhand	1,954	1,979	2,052	1,966	2,068	1,901	2,121	2,206	2,289	2,313
West Bengal	2,509	2,593	2,573	2,533	2,547	2,639	2,688	2,760	2,788	2,731
All India	**2,102**	**2,131**	**2,202**	**2,178**	**2,125**	**2,239**	**2,393**	**2,461**	**2,416**	**2,390**

Note: Figures for 2014-15 are 4th advance estimates. *in 2014-15, yield of Arunachal Pradesh, Goa, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura has been consolidated as 2,488 kg/ha.
Sources: Agricultural Statistics at a Glance 2015; PRS.

Table 12: State wise yield of pulses (in kg/ha)

State/UT	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15
Andhra Pradesh	772	679	803	818	740	675	637	833	928	797
Arunachal Pradesh	1,078	1,078	1,078	1,059	1,000	879	920	1,076	1,149	*
Assam	537	557	558	567	560	555	573	598	695	642
Bihar	749	722	818	801	836	878	975	1,052	1,044	830
Chhattisgarh	477	543	586	580	604	624	613	700	574	834
Goa	1,045	1,358	991	1,030	1,082	1,057	836	902	1,102	*
Gujarat	704	593	843	777	705	812	815	867	897	912
Haryana	622	824	602	972	758	899	706	800	819	692
Himachal Pradesh	713	932	1,062	758	681	1,213	954	1,413	1,763	1,251
Jammu and Kashmir	504	505	508	464	456	584	508	530	535	292
Jharkhand	567	686	736	724	709	773	885	1,038	1,021	1,004
Karnataka	487	377	531	466	451	561	492	555	641	644
Kerala	775	857	857	818	991	778	747	1,042	1,091	1,158
Madhya Pradesh	754	780	609	808	871	656	803	972	861	877
Maharashtra	584	602	746	537	702	768	693	704	802	554
Manipur	523	523	497	504	497	897	942	936	933	*
Meghalaya	750	744	825	867	881	881	896	1,019	1,092	*
Mizoram	1,215	1,160	529	900	1,667	1,534	1,389	1,061	1,468	*
Nagaland	1,281	1,200	1,189	1,203	906	1,085	1,091	1,099	1,124	*
Odisha	416	445	446	481	461	486	471	513	537	527
Punjab	804	850	804	908	896	910	789	823	872	894
Rajasthan	261	462	401	497	204	685	546	603	593	580
Sikkim	897	897	928	937	977	899	903	915	925	*
Tamil Nadu	337	541	303	307	382	386	552	413	752	689
Tripura	629	654	691	718	713	706	697	705	719	*
Uttar Pradesh	811	725	731	899	748	832	993	985	736	618
Uttarakhand	590	642	794	609	719	851	891	841	869	799
West Bengal	785	703	793	704	826	898	706	952	843	713
All India	**598**	**612**	**625**	**659**	**630**	**691**	**699**	**789**	**764**	**744**

Note: Figures for 2014-15 are 4th advance estimates. *in 2014-15, yield of Arunachal Pradesh, Goa, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura has been consolidated as 7,029 kg/ha.
Sources: Agricultural Statistics at a Glance 2015; PRS.

Table 13: State wise yield of oilseeds (in kg/ha)

State/UT	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15
Andhra Pradesh	698	609	1,276	842	724	861	650	849	929	778
Arunachal Pradesh	838	838	962	963	928	921	1,015	909	958	*
Assam	465	495	523	542	526	576	557	610	611	628
Bihar	982	1,031	979	999	1,042	1,048	1,046	1,120	1,189	1,058
Chhattisgarh	419	503	532	507	607	686	550	723	640	595
Goa	2,394	1,769	1,892	2,158	2,807	2,862	2,500	2,409	2,544	*
Gujarat	1,544	908	1,618	1,345	1,109	1,692	1,608	1,103	2,231	1,551
Haryana	1,124	1,344	1,214	1,723	1,645	1,855	1,394	1,712	1,637	1,415
Himachal Pradesh	344	477	442	365	271	514	579	514	490	591
Jammu and Kashmir	429	610	846	760	763	821	826	789	895	670
Jharkhand	311	422	553	560	563	625	680	787	663	652
Karnataka	600	478	681	556	502	782	665	647	824	773
Kerala	667	889	706	696	632	1,032	1,230	1,045	980	1,179
Madhya Pradesh	1,009	955	1,015	1,075	1,129	1,143	1,073	1,231	858	1,090
Maharashtra	925	963	1,274	857	725	1,394	1,223	1,337	1,276	658
Manipur	7,000	7,000	NA	778	778	774	788	729	840	*
Meghalaya	684	673	670	676	701	704	766	695	1,030	*
Mizoram	1,125	927	229	781	1,106	1,203	967	1,078	1,146	*
Nagaland	926	901	896	1,142	835	1,040	1,043	1,047	1,048	*
Odisha	565	550	608	604	589	619	661	700	755	692
Punjab	1,097	1,111	1,288	1,276	1,354	1,336	1,360	1,350	1,335	1,065
Rajasthan	1,134	1,146	1,051	1,114	1,066	1,203	1,243	1,296	1,144	1,192
Sikkim	727	727	872	763	959	832	841	863	887	*
Tamil Nadu	1,624	1,829	1,739	1,782	1,898	2,077	2,479	2,103	2,362	2,292
Tripura	709	705	675	714	717	732	751	506	759	*
Uttar Pradesh	857	993	837	856	865	753	832	828	898	699
Uttarakhand	750	967	1,000	1,138	1,012	1,082	1,236	1,070	892	892
West Bengal	952	918	997	828	1,065	1,047	994	1,162	1,181	1,194
All India	**1,004**	**916**	**1,115**	**1,006**	**958**	**1,193**	**1,133**	**1,168**	**1,168**	**1,037**

Note: Figures for 2014-15 are 4th advance estimates. *in 2014-15, yield of Arunachal Pradesh, Goa, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura has been consolidated as 1,070 kg/ha.
Sources: Agricultural Statistics at a Glance 2015, Ministry of Agriculture; PRS.

Table 14: Coverage of micro-irrigation in states (in hectares)

State/UT	Drip	Sprinkler	Total	% of net sown area under micro-irrigation
Andhra Pradesh	8,34,865	3,28,441	11,63,306	10.5%
Arunachal Pradesh	613	-	613	0.3%
Assam	310	129	439	0%
Bihar	4,610	97,440	1,02,050	1.9%
Chhattisgarh	15,553	2,41,420	2,56,973	5.5%
Goa	965	899	1,864	1.4%
Gujarat	4,11,208	4,18,165	8,29,373	8.1%
Haryana	22,682	5,50,458	5,73,140	16.3%
Himachal Pradesh	291	684	975	0.2%
Jharkhand	6,303	9,919	16,222	2.2%
Karnataka	4,29,903	4,17,005	8,46,908	60.2%
Kerala	22,516	6,948	29,464	0.3%
Madhya Pradesh	1,66,358	1,85,759	3,52,117	17.2%
Maharashtra	8,96,343	3,74,783	12,71,126	8.3%
Manipur	47	30	77	0%
Mizoram	1,727	425	2,152	0.7%
Nagaland	200	5,005	5,205	1.8%
Odisha	18,431	82,147	1,00,578	86.7%
Punjab	30,805	12,161	42,966	11.3%
Rajasthan	1,70,098	15,14,451	16,84,549	38.4%
Sikkim	5,544	2,769	8,313	0.2%
Tamil Nadu	2,90,009	30,436	3,20,445	1.8%
Telangana	25,299	5,293	30,592	39.7%
Tripura	100	392	492	0%
Uttar Pradesh	15,519	21,164	36,683	14.3%
Uttarakhand	696	316	1,012	0.1%
West Bengal	604	50,576	51,180	0.3%
Others	15,500	31,000	46,500	0.9%
All India	**33,87,099**	**43,88,215**	**77,75,314**	**5.6%**

Sources: Agricultural Statistics at a Glance 2015, Ministry of Agriculture; PRS.

Table 15: Ground water development and coverage of irrigation in states

State	Ground water development (%)	% Irrigated area
Andhra Pradesh	45%	38.0%
Arunachal Pradesh	0%	13.0%
Assam	14%	5.4%
Bihar	44%	47.8%
Chhattisgarh	35%	26.4%
Goa	28%	40.4%
Gujarat	137%	41.2%
Himachal Pradesh	71%	11.4%
Haryana	67%	90.2%
Jharkhand	21%	3.7%
Jammu and Kashmir	133%	39.9%
Karnataka	32%	26.9%
Kerala	64%	22.2%
Maharashtra	57%	16.7%
Meghalaya	0%	20.9%
Manipur	1%	18.6%
Madhya Pradesh	47%	43.8%
Mizoram	4%	9.5%
Nagaland	6%	7.0%
Odisha	28%	26.2%
Punjab	172%	99.5%
Rajasthan	26%	31.9%
Sikkim	137%	15.9%
Tamil Nadu	77%	50.2%
Tripura	7%	21.4%
Uttarakhand	74%	40.9%
Uttar Pradesh	57%	76.2%
West Bengal	40%	62.2%
All states	**62%**	**47.2%**

Sources: Central Water Commission; Agricultural Census 2011; PRS.

Table 16: Legal status of land leasing in states as of October 2016

State/UT	Land leasing restriction	Adoption of Model land leasing law
Andhra Pradesh	Partial	No
Arunachal Pradesh	Ban	No
Assam	Partial	No
Bihar	Ban	No
Chhattisgarh	Ban	No
Goa	Ban	No
Gujarat	Ban	No
Haryana	Partial	No
Himachal Pradesh	Ban	No
Jammu and Kashmir	Ban	No
Jharkhand	Ban	No
Karnataka	Ban	No
Kerala	Ban	No
Madhya Pradesh	-	Yes
Maharashtra	Partial	No
Manipur	Ban	No
Meghalaya	Ban	No
Mizoram	Ban	No
Nagaland	Ban	No
Odisha	Ban	No
Punjab	Partial	No
Rajasthan	Partial	No
Sikkim	Ban	No
Tamil Nadu	Partial	No
Telangana	Ban	No
Tripura	Partial	No
Uttar Pradesh	Partial	No
Uttarakhand	Ban	No
West Bengal	Partial	No
Andaman and Nicobar Islands	Ban	No
Chandigarh	Ban	No
Dadra and Nagar Haveli	Ban	No
Daman and Diu	Ban	No
Delhi	Ban	No
Lakshadweep	Ban	No
Puducherry	Ban	No

Sources: Study Report on Agriculture Marketing and Farmer Friendly Reforms Across Indian States, NITI Aayog; PRS.

Table 17: MSPs for major crops 2005-2016 (in Rs/quintal)

Crop	2005-06	2010-11	2016-17	% increase 2010-11 to 2016-17	% increase 2005-06 to 2016-17
Paddy Common	570	1,000	1,470	6.6%	9.0%
Jowar Hybrid	525	880	1,625	10.8%	10.8%
Maize	540	880	1,365	7.6%	8.8%
Ragi	525	965	1,725	10.2%	11.4%
Tur (Arhar)	1,400	3,500	5,050	6.3%	12.4%
Moong	1,520	3,670	5,225	6.1%	11.9%
Urad	1,520	3,400	5,000	6.6%	11.4%
Groundnut-in-shell	1,520	2,300	4,220	10.6%	9.7%
Sesamum	1,520	2,900	5,000	9.5%	11.4%
Cotton medium staple	1,760	2,500	3,860	7.5%	7.4%
Cotton long staple	1,980	3,000	4,160	5.6%	7.0%
Wheat	700	1,170	1,625	5.6%	8.0%
Masur	1,535	2,250	3,950	9.8%	9.0%
Rapeseed/mustard	1,715	1,850	3,700	12.2%	7.2%

Note: MSPs include the bonuses declared for certain crops.
Sources: Directorate of Economics and Statistics, Ministry of Agriculture; PRS.

Table 18: Status of APMC reforms in states as of October 2016

State/UT	Fruits and vegetables out of APMC	Taxes on agricultural commodities	Direct selling by producers	e-NAM	Number of markets under NAM
Andhra Pradesh	Not done	7.0%	Yes	Yes	5
Arunachal Pradesh	Not done	2.0%	Yes	No	0
Assam	Done	1.0%	Yes	No	0
Bihar	Not done	0.0%	No	No	0
Chhattisgarh	Partial	2.0%	Yes	Yes	12
Goa	Not done	5.0%	Yes	No	0
Gujarat	Done	5.8%	Yes	Yes	40
Haryana	Partial	10.5%	Yes	Yes	36
Himachal Pradesh	Partial	7.0%	Yes	Yes	7
Jammu and Kashmir	Not done	0.0%	No	No	0
Jharkhand	Not done	5.3%	Yes	Yes	8
Karnataka	Partial	7.5%	Yes	No	0
Kerala	Not done	3.0%	No	No	0
Madhya Pradesh	Partial	2.0%	Yes	Yes	20
Maharashtra	Partial	3.0%	Yes	Yes	0
Manipur	Not done	0.0%	No	No	0
Meghalaya	Done	1.0%	No	No	0
Mizoram	Not done	0.0%	Yes	No	0
Nagaland	Partial	0.0%	Yes	No	0
Odisha	Done	5.5%	No	No	0
Punjab	Not done	13.5%	Yes	No	0
Rajasthan	Partial	2.8%	Yes	Yes	11
Sikkim	Not done	1.3%	Yes	No	0
Tamil Nadu	Not done	5.0%	No	No	0
Telangana	Not done	0.0%	Yes	Yes	44
Tripura	Not done	2.0%	Yes	No	0
Uttar Pradesh	Not done	4.0%	No	Yes	66
Uttarakhand	Not done	9.0%	Yes	No	0
West Bengal	Partial	5.0%	Yes	No	0
Andaman and Nicobar Islands	Not followed	0.0%	No	No	0
Chandigarh	Not followed	10.5%	Yes	No	0
Dadra and Nagar Haveli	Not followed	0.0%	No	No	0
Daman and Diu	Not followed	0.0%	No	No	0
Delhi	Partial	7.0%	No	No	0
Lakshadweep	Not followed	0.0%	No	No	0
Puducherry	Not followed	4.8%	No	No	0

Sources: Study Report on Agriculture Marketing and Farmer Friendly Reforms Across Indian States, NITI Aayog; PRS.